MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Microgravity Experiments from Sub-Orbital to Orbital Platforms (3)

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DESIGN OF THE MAIUS-2/3 ATOM INTERFEROMETER ON A SOUNDING ROCKET

Abstract

Two sounding rocket missions, MAIUS-2 and MAIUS-3, aimed at the first generation of a Potassium 41 Bose-Einstein-Condensate (BEC) in space, atom interferometry with Potassium 41 and simultaneous atom interferometry with Potassium 41 and Rubidium 87 are currently in preparation. They are planned to be launched in 2017 and 2018 from Esrange in Sweden on-board a VSB-30 sounding rocket providing approximately 360 s of microgravity time. The payload is based on the MAIUS-1 concept and divided into five subsystems: Physics package, laser system, laser electronics, electronics, and batteries. This paper describes the redesign and optimization of the subsystems compared to MAIUS-1 (Rubidium BEC) and with respect to the scientific objectives of MAIUS-2/3 (Rubidium and Potassium BECs). To operate the MAIUS-2/3 experiment, more components in the laser system and (laser-) electronics are needed. Without a design improvement this would cause a higher mass (in total 340-360 kg) and length compared to MAIUS-1 (275 kg and 2.79 m). Nevertheless the weight and length limits (280 kg payload, 3m length) for a stable re-entry and no loss of microgravity time remain the same. Therefore, the laser system, laser electronics and electronics had to be optimized and redesigned and will be described in more detail. The BEC is created within the physics package. It is divided into the experimental chamber and its pumping section consisting of an ion getter pump and a titanium sublimation pumps. An ultra-high vacuum below 5E-10 mbar is needed inside the experimental chamber to create BECs. The new pumping concept with respect to the requirements will be shown in more detail. To qualify the subsystems for the launch several vibration tests have been performed and the results will also be presented in this paper.